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**College of Agricultural, Consumer  
and Environmental Sciences**  
Agricultural Experiment Station

## **AGRICULTURAL SCIENCE CENTER AT FARMINGTON**

# **2023 ANNUAL REPORT**

**THE NMSU AGRICULTURAL EXPERIMENT  
STATION SUPPORTS RESEARCH THAT  
ADDRESSES REAL-WORLD PROBLEMS.  
RESEARCH IS AT THE CORE OF NMSU'S  
MISSION TO IMPROVE THE LIVES OF  
PEOPLE GLOBALLY.**

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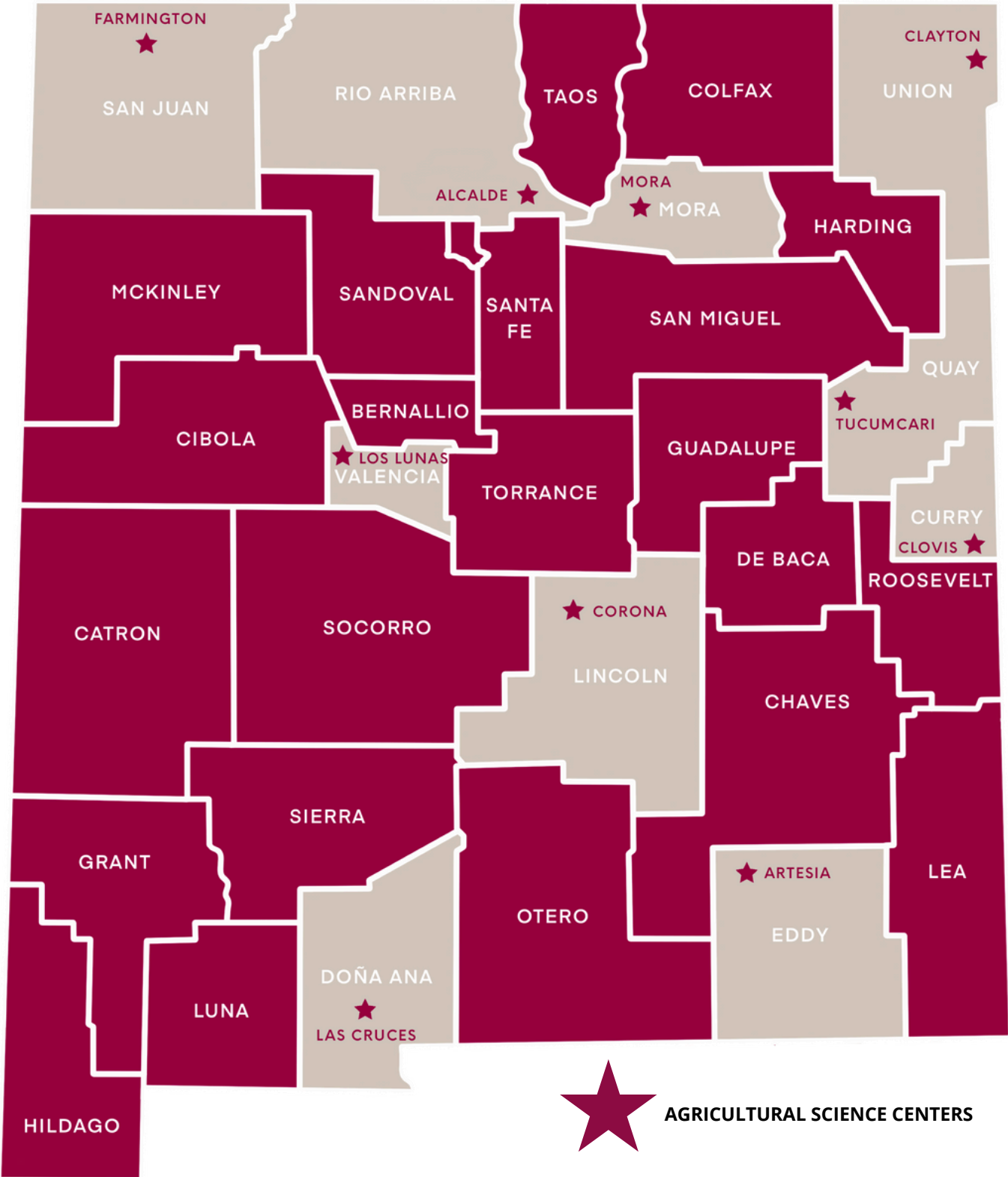
# NOTICE TO USERS OF THIS REPORT

These are not formal Agricultural Experiment Station research results. Readers are cautioned against drawing conclusions or making recommendations as a result of the summaries in this report. In many instances, data represents only one of several years' results that will ultimately constitute the final formal report for a project.

None of the data are authorized for release or publication without the written prior approval of the New Mexico Agricultural Experiment Station.

Any reference in this report to any person, organization, activities, products, or services related to such person or organization is solely for informational purposes and does not constitute or imply the endorsement or recommendation of New Mexico State University or any of its employees or contractors. NMSU is dedicated to providing equal opportunities in areas of employment and academics without regard to age, ancestry, color, disability, gender identity, genetic information, national origin, race, religion, serious medical condition, sex, sexual orientation, spousal affiliation, or protected veteran status as outlined in federal and state anti-discrimination statutes. The College of Agricultural, Consumer, and Environmental Sciences is an engine for economic and community development in New Mexico. ACES academic programs help students discover new knowledge and become leaders in environmental stewardship, food and fiber production, water use and conservation, and improving the health of all New Mexicans. The College's research and extension outreach arms reach every county in the state and provide research-based knowledge and programs to improve the lives of all New Mexicans.

# AGRICULTURAL SCIENCE CENTER LOCATIONS MAP





# EXECUTIVE SUMMARY

Since 1967, the mission of the New Mexico State University Agricultural Science Center at Farmington has been to conduct research, demonstration, and educational programs that will best fill the needs of the agricultural community of San Juan County and the Navajo Nation in particular, and the State of New Mexico, Four Corners Region, and the United States in general.

While the ASC Farmington is a physical location located about 10 miles south of Farmington, its research, educational, and outreach activities extend well beyond into the surrounding Four Corners Region. The core activities focus on agronomic and horticultural cropping systems and into several multi-disciplinary transects with community development, health, and resiliency themes. These activities align with the College of Agricultural, Consumer & Environmental Sciences (ACES) Four Pillars: Water Use and Conservation, Family Development and Health of New Mexicans, Environmental Stewardship, and Foundational Education and Training (<https://aces.nmsu.edu/about/pillars.html>) and NMSU LEADS 2025: to enhance student success, elevate research, amplify outreach, and build a robust university system (<https://leads2025.nmsu.edu/>).

It is important to acknowledge the NMSU-ASC Farmington faculty and staff and all other collaborators and funding mechanisms for making the efforts reported herein happen. High school and undergraduate interns and graduate students are also an integral part of the research process.

Each project summary contains overviews of the project, impacts, collaborative partners, funding acknowledgments, and contact information for more detailed information. Some example summaries include potato nitrogen and irrigation use efficiency, viticulture, gardening for diabetes risk reduction, examining cover crops and issues related to transitioning to USDA-certified organic production, Navajo Peach project, and a farmers needs assessment survey; outreach events involving youth and adults are also included.

Operational and salary support is partially through the Hatch Act of 1887, which established funding to “conduct agricultural research programs at State Agricultural Experiment Stations in the 50 states, the District of Columbia, and the U.S. insular areas”. We appreciate continued support through the New Mexico Legislature, which made possible additional salary support and capital improvements that included in 2023 renovations to our caretaker’s house and other machines and implements to conduct high-quality agricultural research. We want to thank the Navajo Nation for their continued support of a unique land lease agreement and acknowledge the Navajo Nation for the land on which the ASC at Farmington resides and the irrigation water provided through the Navajo Indian Irrigation Project (NIIP).



In 2023, the ASC Farmington advisory committee helped to develop a new vision: Building agricultural and community resilience with innovative science that respects regional cultural values in the Four Corners Region (Navajo Nation and Beyond). As a result, new project initiatives funded in 2023 include the planned development of an integrated agricultural photovoltaic (solar power) research garden and exploration into hydroponics with controlled environment (greenhouse) systems. New faculty hires initiated in 2023 will help add capacity to these new and emerging fields of agricultural research.



# RESEARCH HIGHLIGHTS





# DEVELOPING REGION-SPECIFIC GUIDELINES FOR SELECTING COVER CROP SPECIES IN NEW MEXICO

Investigators: Brian Schutte (bschutte@nmsu.edu), Mark Marsalis, Kevin Lombard, and Rajan Chimire

## PROJECT OVERVIEW

A principal challenge for agriculture is to fulfill increasing demands for food, fiber, and bioenergy while minimizing negative environmental impacts. Addressing this challenge involves replacing external inputs of energy and agrochemicals with the management of biodiversity in crop production systems. Means for diversifying crop production systems include cover crops between periods of cash crop growth. Cover crops provide multiple ecosystem services linked to agricultural soils, which are foundations for crop yield formation. The purpose of this project is to develop region-specific guidelines for selecting cover crop species in New Mexico.

## MEETING THE NEEDS OF NEW MEXICO

Current guidelines for selecting cover crop species in New Mexico include qualitative descriptors on performance (Excellent, Very Good, Good) derived from national and state-level summaries. Such generalizations are useful. But, to help New Mexico farmers and crop consultants select species best for their location, selection guidelines should include information on cover crop performance resulting from studies conducted within their region of New Mexico.

## IMPACT

By generating information that will help farmers and consultants select cover crop species and mixtures ideally suited for their region of New Mexico, this project will enhance agroecosystem resiliency to climate change and create conditions that sustain productivity in the future.

### FUNDING ACKNOWLEDGMENT:

U.S. Department of Agriculture and Natural Resources Conservation Service

### COLLABORATING AGRICULTURAL SCIENCE CENTERS:

Clovis Agricultural Science Center, Leyendecker Plant Science Center, and Agricultural Science Center at Los Lunas



# USING COVER CROPS IN TRANSITIONING FROM TRADITIONAL AGRICULTURE TO CLIMATE-ADAPTIVE ORGANIC FARMING IN THE SOUTHWESTERN U.S.

Investigators: Richard C. Pratt (/ricpratt@nmsu.edu), Koffi Djaman, Aminou Saibou, Brian Schutte, Kevin Lombard, and Michael Patrick

## PROJECT OVERVIEW

To identify summer cover crop species suitable for limited irrigation under semi-arid conditions, four grasses and four legume cover crops were evaluated at Fabian Garcia Research Center. In addition to the single species, two-way blends were evaluated at the Farmington Agricultural Science Center. Soil moisture data and aboveground cover crop and weed biomass were collected to calculate the Cover Crop Weed Index. Results showed that good cover crop biomass could be achieved with limited irrigation. The two varieties of Sorghum-Sudangrass and Pearl millet produced more aboveground dry biomass than the other cover crops. Moreover, pearl millet and sorghum-sudangrass varieties showed an outstanding weed control followed by sunn hemp with an excellent weed control. In Farmington, sudax grayhawk, pearl millet, sunn hemp-sudax grayhawk, ace cowpea-sudax grayhawk, and tepary beans-sudax grayhawk did well suppressing weeds.

## MEETING THE NEEDS OF NEW MEXICO

Identifying summer cover crops that could use less irrigation water, suppress weeds, and improve soil health will contribute to reducing irrigation water use and increasing ecosystem services on New Mexico farms. These findings may help make farming more sustainable for New Mexico farmers. Especially those seeking to transition to climate-adaptive organic farming. During the transition process, farmers in New Mexico may use the selected summer cover crops to improve ecosystem services on their farms and reduce the costs of irrigation and weed management.

## IMPACT

- This project will lead to:
- Reduction in irrigation water use for summer cover crop production
  - Reduced costs for weed management in organic farming
  - Enhanced ecosystem services
  - Increased number of organic farms in the southwestern US
  - Availability of summer forage crops for livestock in the southwestern US

### FUNDING ACKNOWLEDGMENT:

National Institute of Food and Agriculture Organic Transitions Program  
**COLLABORATING AGRICULTURAL SCIENCE CENTERS:**  
Fabian Garcia Research Center





# COLD TOLERANCE OF PUNCTUREVINE WEEVILS

Investigators: Kristen Bowers (kebowers@nmsu.edu), Dan Bean, and Kevin Lombard

## PROJECT OVERVIEW

There is disagreement about what factors limit puncturevine weevil populations in the northern United States. Anecdotally, some practitioners and land managers believe that weevils that are established at higher latitudes are more cold tolerant than those in the desert southwest. Researchers attempted to clarify if cold tolerance was a factor in the distribution and abundance of puncturevine weevils by 1) surveying puncturevine plants across New Mexico and Colorado to see where populations of weevils were established and 2) measuring the ability of weevils from both colder and warmer locations to survive in outdoor overwintering cages.

## MEETING THE NEEDS OF NEW MEXICO

Identifying sources of cold hardy weevils and increasing the supply of these biotypes would provide landowners and managers with additional tools to manage puncturevine in parts of New Mexico. Understanding the factors determining weevil distribution across latitudes will suggest strategies for managing puncturevine.

## IMPACT

Based on both field and lab results, there does not appear to be biologically meaningful differences in cold tolerance among populations of weevils in New Mexico and Colorado. This suggests that in the shorter term, biological control of puncturevine could benefit from mass rearing and release of weevils annually to reduce the viable seed bank. Longer-term solutions could include additional native host range exploration for more cold-hardy biotypes or additional biological control agents.

### FUNDING ACKNOWLEDGMENT:

Western IPM Centers 2022-2023 and USDA-APHIS 2024



# ALFALFA VARIETY PERFORMANCE EVALUATION: 2020 PLANTED

## ALFALFA TRIAL

Investigators: Koffi Djaman (kdjaman@nmsu.edu), Margaret M. West, D. Begay, J. Thomas, C. Begay, and Jonah Joe

### PROJECT OVERVIEW

The August 20, 2020, Planted Alfalfa Variety Trial is part of a statewide testing program to help determine which alfalfa (*Medicago sativa*) fall dormancy ratings will perform best in the different geographic areas across New Mexico. This study is coordinated through the NMSU Plant and Environmental Sciences Department. The 2020 trials consist of 14 cultivars from public varieties and private seed companies. Alfalfa is irrigated using crop ET-based irrigation scheduling and harvested each time at 10% blooming. Overall alfalfa is harvested four times a season. The research plot was kept weed-free by Pursuit herbicide applied in March at the labeled rate. The project started in Fall 2020, ended in November 2023, and all three-year results are published at [https://pubs.nmsu.edu/variety\\_trials/AVT23.pdf](https://pubs.nmsu.edu/variety_trials/AVT23.pdf).

### MEETING THE NEEDS OF NEW MEXICO

Alfalfa is a major hay crop in New Mexico and in San Juan County, and has long been studied at ASC Farmington, with performance results shared annually with the public. This research helps the alfalfa hay grower with guidelines on alfalfa fall dormancy rating selection with their geographic location.

### IMPACT

Alfalfa is a major hay crop in the region. It is important to know which fall dormancy ratings or varieties have the best long-term yields and pest tolerance under local conditions. This information is helpful for alfalfa growers who wish to maximize yields considering fall dormancy ratings, yield index, winter hardiness, and water constraints.

### COLLABORATING AGRICULTURAL SCIENCE CENTERS:

Artesia Agricultural Science Center, Leyendecker Plant Science Center, Agricultural Science Center at Los Lunas, Rex E. Kirksey Agricultural Science Center at Tucumcari



# EFFECTS OF IRRIGATION AND NITROGEN MANAGEMENT ON POTATO GROWTH, YIELD, QUALITY, WATER, AND NITROGEN USE EFFICIENCIES

Investigators: Koffi Djaman (kdjaman@nmsu.edu), Margaret M. West, G. Martinez, D.

Begay, J. Thomas, and C. Begay

## PROJECT OVERVIEW

Potato yield and tuber quality are affected by the irrigation amount and nitrogen fertilizer application rates. A field experiment was conducted to evaluate the performance of two chip potato varieties under three irrigation regimes and seven nitrogen rates during the 2022 and 2023 growing seasons. Plant height, canopy cover, total and marketable tuber yields, and water and nitrogen use efficiencies were evaluated. Potato tuber yield was reduced in 2023 due to the heat stress during the growing season.

## MEETING THE NEEDS OF NEW MEXICO

The present study helps New Mexican potato producers cope with the recurrent drought across the state and using the nitrogen-potato production function helps in increasing farm net revenue while reducing production costs and protecting the environment.

## IMPACT

This study aims to develop nitrogen fertilizer production functions for potatoes under different irrigation regimes including water-saving strategies. The outcome of this research holds the potential to increase potato growers' net economic returns as well as reduce soil and groundwater pollution by nitrates by applying the optimum nitrogen fertilizer rate under 80% of the crop water requirements.





# CHIP AND TABLE POTATO GENOTYPE EVALUATION AND CROPPING SYSTEMS

Investigators: Koffi Djaman (kdjaman@nmsu.edu), Margaret M. West, G Martinez, D. Begay, J. Thomas, and C. Begay

## PROJECT OVERVIEW

The 2023 Potato Trial consisted of ten chip potato cultivars and ten table potato cultivars planted within four replications. Potatoes were harvested and processed at the Navajo Mesa Farms (NMF) laboratory. Center pivot irrigation was scheduled according to site evapotranspiration rate and the recommended fertilization was applied based on soil testing. Potato psyllids (*Bactericera cockerelli*) were monitored weekly. Tuber size distribution, and total and marketable tuber yield were significantly higher for some breeder clones compared to some well-known varieties. Tuber-specific gravity is good at Farmington compared to lower elevation-producing areas. Sugars, fry defects, and chip color were monitored regularly during the post-harvest nine-month storage season to determine long-term storage quality. The chip potato research data is entered into the Potatoes USA database for use by all growers, processors, and breeders across the United States.

## MEETING THE NEEDS OF NEW MEXICO

The Four Corners region has a very favorable climate for potato production and the disease pressure is low. Navajo Agricultural Products Industry (NAPI) and Navajo Mesa Farms (NMF) are large-acreage potato producers in the region and the present study selects for high-yielding and adapted potato cultivars for the growers to improve their production system profitability in a sound environment..

## IMPACT

Chip and Table potato varietal research is necessary to find locally adapted and high-yielding cultivars with better storage quality for potato growers of the Four Corners region.

### FUNDING ACKNOWLEDGMENT:

Potatoes USA





# WEED SUPPRESSION AND GRAIN YIELD OF FINE EDIBLE DRY BEAN UNDER TWO PLANTING PATTERNS AND DENSITIES

Investigators: Koffi Djaman (kdjaman@nmsu.edu), Margaret M. West, G. Martinez, D. Begay, J. Thomas, C. Begay, and J. Joe

## PROJECT OVERVIEW

Five different bean varieties were planted under two different planting patterns and two densities to evaluate their capacity for weed suppression and yield potential. The highest weed suppression was obtained by black bean followed by small red, great northern, pinto, and red kidney. The great northern yielded the highest followed by the small red, pinto, the black bean, and the red kidney. The black bean suppressed weeds the most followed by great northern, pinto, small red, and the red/kidney. The 18-inch row spacing is more effective than the 36-inch row spacing for weed suppression. The four bean varieties (great northern, pinto, small red, and black bean) are the best candidates for the double objectives of weed suppression and yield in northwest New Mexico.

## MEETING THE NEEDS OF NEW MEXICO

Successful identification of dry bean varieties in New Mexico to replace fallow periods common in semi-arid cropping systems will assist local producers in achieving higher water-use efficiency and productivity. It could also promote the state-level infrastructure and broader marketing opportunities in New Mexico.

## IMPACT

The introduction of efficient resource-use crop selection will result in broader diversity in the existing cropping systems. Understanding the water-use efficiency dynamics of dry beans and increasing the diversity in the cropping systems may reduce the seasonal risk of crop failures due to water scarcity and increase farm-level income security.

### FUNDING ACKNOWLEDGMENT:

Hatch Appropriations



# WINTER MALTED BARLEY TRIAL FOR CRAFT BEVERAGE INDUSTRIES

Investigators: Kevin Lombard (klombard@nmsu.edu), G. Martinez, D. Begay, and F.J. Thomas

## PROJECT OVERVIEW

The University of Minnesota Barley Breeding program organizes the Winter Malting Barley Trial (WMBT), which is a collaboration between Public and Private Breeders and Agricultural Science Centers spanning the entire United States. Two goals of the WMBT are to identify winter barley lines that meet malt industry standards and to expand winter barley acreage <https://smithlab.cfans.umn.edu/winter-malting-barley-trial>. Historically, U.S. breeding programs focused on breeding 6-row malting barley; however, with the boom of the craft brewing industry in the last decade, many breeders have turned their focus towards 2-row malting barley. Winter barley is seeded in the fall (Sept-Oct) and survives the winter by going dormant. True winter barley requires a period of cold before they can flower in the spring. Genetic material/varieties in the WMBT are screened for winter survival, vigor, lodging, disease, yield, moisture, and protein.

## MEETING THE NEEDS OF NEW MEXICO

Winter barley is generally higher yielding than spring types and also tends to have other beneficial attributes including soil stabilization during winter months (soil erosion is common in NM due to high winds encountered in the spring) and avoidance of planting delays caused by inclement weather events encountered in the spring. Winter barley also allows for an earlier harvest which would allow NM growers to plant a second crop in the same year, therefore resulting in more robust and diverse cropping systems.

## IMPACT

In 2022, New Mexico Craft Breweries had an economic impact of \$338 million with 104 craft breweries operating in the state. The state also ranked 32nd in the nation in terms of production with 159,753 barrels of craft beer produced within that same year. Distillates are also an emerging craft beverage in the state. Barriers to WMB production are specialized combining equipment for harvesting and malting facilities for post-harvest processing (the nearest commercial facility is located in San Luis Valley of Colorado). Winter malted barley, however, has proven to be a viable crop for NW NM and provides opportunities for an important locally sourced ingredient in the craft beverage industry.

### FUNDING ACKNOWLEDGEMENT:

Hatch Appropriations

### COLLABORATING AGRICULTURAL SCIENCE CENTERS:

Rex E. Kirksey Agricultural Science Center at Tucumcari



# ANCIENT AND HERITAGE GRAIN TRIAL FOR CULINARY AND CRAFT BEVERAGE INDUSTRIES IN NM

Investigators: Kevin Lombard (klombard@nmsu.edu), G. Martinez, D. Begay, and F.J. Thomas

## PROJECT OVERVIEW

Ancient and Heritage grains are generally described as those that are largely unchanged over the last several hundred to thousands of years. Examples in this study include Tibetan Purple Barley, Ethiopian Blue-Tingled Emmer, Arabian Blue Barley, Sonoran White Wheat, and others. This trial seeks to identify, seed increase and trial heritage and ancient grain varieties (wheat, rye, and barley) in the high desert plain of San Juan County and northern New Mexico. Ancient and heritage grains can be planted in the fall (Sept-Oct) similar to winter barley or in the spring. These grains can also give the same benefits of soil cover and erosion control and tend to be harvested just a week or two after winter barley. Similarly, genetic material/varieties in the Ancient and Heritage Grain Trial are screened for winter survival, vigor, lodging, disease, yield, moisture, and protein.

## MEETING THE NEEDS OF NEW MEXICO

Ancient and Heritage grain varieties are older varieties that have been grown in the past and are experiencing a resurgence in interest. As consumers become more attracted to localized food production, older crop varieties are gaining favor. In New Mexico, there is certainly potential for these ancient grain varieties with their nutritional and flavor profiles to be integrated into local value-added food and beverage markets. These ancient grains also provide more opportunities for NM growers to diversify existing cropping systems already in practice.

## IMPACT

This trial offers the potential to identify ancient and heritage grains best adapted to northwest NM and provide growers opportunities to an expanding consumer market seeking old flavors and health benefits of these cereal grain crops.

### FUNDING ACKNOWLEDGMENT:

Hatch Appropriations





# NAVAJO PEACH PROJECT

Investigators: Reagan Wytsalucy (Reagan.wytsalucy@usu.edu), Kevin Lombard, and Bud Lopez

## PROJECT OVERVIEW

In June 2023, Reagan Wytsalucy returned to the ASC Farmington with cuttings and the seed of “Navajo Peaches” (*Prunus persica* (L.) Batsch) which have been described in historical texts and more recently in research peer review in HortScience (<https://journals.ashs.org/hortsci/view/journals/hortsci/54/5/article-p799.xml>). Staff and interns from the ASC Farmington along with Bud Lopez (NMSU Tribal CES) helped prepare potting soil and “stick” cuttings and sow seed in the greenhouse. ASC Farmington staff are caring for the seedlings daily. This is the second year of propagation work, and researchers look forward to expanding the nursery in subsequent years. This study includes institutional review board (IRB) support from the Navajo Nation Human Research Review Board, Chinle and Shonto Chapters, Canyon de Chelly National Park Service, Utah State University, and Naatsis’aan Development Association in addition to our support at NMSU ASC Farmington.

## MEETING THE NEEDS OF NEW MEXICO

The peaches have a story of hope and resilience and one must understand the history of the Diné people to fully appreciate this story. Ms. Wytsalucy is utilizing space at the ASC Farmington greenhouse to propagate the unique peach genetics for repatriation back to Navajo farms.

## IMPACT

This study is one of several ongoing projects Ms. Wytsalucy is working on to restore the Navajo Peaches to their historically farmed areas. Ms. Wytsalucy also has collaborations with 2 other Navajo farmers to propagate the peach trees for eventual relocation into the Navajo communities and to preserve the pure germplasm from the selected seedlings. The crops’ perennial nature and historical growing practices prolong this project at our facility for at least three more years as our team of experts begins work to identify rooted cutting methods for the eventual replanting of the trees into their native habitats to increase food security within the Southwestern communities.

### FUNDING ACKNOWLEDGMENT:

Utah Department of Agriculture and Food





# GRAPE (VITICULTURE) RESEARCH

Investigators: Kevin Lombard (klombard@nmsu.edu), William Giese (Arkansas State University), Ciro Vela-Cruz, Bernd Maier (Armijo Winery)

## PROJECT OVERVIEW

Some growers consider grapes as part of a diversified farm economy to include fresh markets (table grapes) and for value added (e.g., jams, jellies, wine, and distillates and agritourism like wineries and tasting rooms). Several trials include 1) non-grafted *Vitis vinifera* and interspecific hybrid wine and table grape cultivars planted in 2007, 2) a rootstock trial planted in 2009 (2 scions, 'Refosco' and 'Gewurztraminer', grafted onto 9 different rootstocks; and 3) miscellaneous trials including grapes from the original 1968 Four Corners Grape Study. A recent table grape study planted in 2020 includes cultivars 'Reliance', 'Marquis', 'Glenora', and 'Interlaken' (industry standards), and 'Compassion', 'Neptune', 'Hope', 'Faith', 'Joy', 'Gratitude', 'Swenson Red', and 'Everest Seedless' planted on a "Y" type trellis.

## MEETING THE NEEDS OF NEW MEXICO

The challenges of growing grape vines in Northwest New Mexico are mainly related to a high elevation that exceeds 1,700 m (5,500 ft) and begins to "push the envelope" of cold winter temperature tolerance for many grape varieties. Killing spring frosts (that kill flowers and leaves after bud break), exacerbated by low-lying sites adjacent to rivers prone to frost pockets can also be common in Farmington. On the other hand, low humidity found in Northwest New Mexico equates to low fungal disease pressure which essentially means grapes can be grown without the need for fungicide applications. Farmington's semi-arid climate and wide diurnal temperature fluctuation (hot days and cool nights) at the time of late summer berry ripening, is ideal for producing high sugar content in early ripening cultivars. Determining these cultivars is the objective of these studies.

## IMPACT

In 2022, New Mexico's 57 wine producers and associated hotel, restaurant, and tourism industries generated approximately \$1.12 billion in total economic activity according to a National Economic Impact Study by The National Association of American Wineries, up from \$876 million in 2020 (<https://wineamerica.org/economic-impact-study/new-mexico-wine-industry/>). The Four Corners region supports at least 6 commercial wineries. These studies are contributing to understanding grape cultivar performance with the potential to expand regional viticulture in mesoclimates adapted to grape production. San Juan County has a tremendous amount of variability in terms of soils that range from slightly acidic to alkaline, and temperatures that vary depending on elevation or distance from low-lying riverbeds (consider frost pockets). Before considering grapes, growers are encouraged to know what their soil conditions are (soil test) and their site temperatures (monitored with a min/max thermometer). Planting grapes is a considerable investment.

### FUNDING ACKNOWLEDGMENT:

New Mexico Department of Agriculture Specialty Crop Block Grant (Completed), Hatch Appropriations, New Mexico Office of Attorney General

### COLLABORATING AGRICULTURAL SCIENCE CENTERS:

Sustainable Agriculture Science Center at Alcalde, Fabian Garcia Research Center, and Agricultural Science Center at Los Lunas

# GRAPE (VITICULTURE) RESEARCH

Investigators: Kevin Lombard (klombard@nmsu.edu), William Giese (Arkansas State University), Ciro Vela-Cruz, Bernd Maier (Armijo Winery)



# TRANSFORMATION NETWORK FOUR CORNERS, THREE RIVERS WORKING GROUP OF THE SRS RN: TRANSFORMING RURAL-URBAN SYSTEMS: TRAJECTORIES FOR SUSTAINABILITY IN THE INTERMOUNTAIN WEST

Investigators: Kevin Lombard (klombard@nmsu.edu), Melinda Morgan and Lani Tsinnajinnie (University of New Mexico), Jan Boll (Washington State University), Richard Rushforth (Northern Arizona), Karletta Chief, Debunker Sanyeal and Kelly Simmons-Potter (University of Arizona)

## PROJECT OVERVIEW

The Transformation Network (<https://transformimw.unm.edu/>) represents a partnership between eight Western U.S. universities with over 50 partner organizations representing Tribal partners, governmental and non-governmental organizations, public utilities, conservation districts, irrigation districts, and municipalities.

The Transformation Network (TN) aims to support convergent research and education that will advance sustainable regional systems of science, engineering, and education along three core themes: 1) Resilient headwaters, 2) Food-Energy-Water systems, and 3) Innovative and equitable governance and institutions.

The ASC Farmington serves as the NMSU institutional lead of predominantly place-based research and outreach encompassing Food-Energy-Water topics in Northwest, NM, and the Navajo Nation within the Four Corners, Three River's Working Group. In 2023, NMSU Ag Science Center, Farmington assisted the San Juan Soil and Water Conservation District SJSWCD (office in Aztec, NM) with the Healthy Soil project through cover cropping recommendations and workshops. This soil monitoring project, working directly with Navajo farmers in western San Juan County, NM, laid the groundwork for a needs assessment survey launched in June 2023 and with approval through the University of AZ, NMSU, and Navajo Nation Human Research Review Boards. Other overlapping projects include supply chain mapping of the regional economy.

## MEETING THE NEEDS OF NEW MEXICO

With a focus on controlled environment agriculture, perceptions of agricultural photovoltaics, soil health, and supply chain mapping, the phase of the project seeks to gain an understanding of the needs of Northwest NM farmers and community.

## IMPACT

The results will guide specific interventions in a more purposeful and coordinated manner, guided by community members. The anticipated impact of this work will be to inform specific research and extension work by service providers operating in the region, many of whom are affiliated with the TN.

### FUNDING ACKNOWLEDGMENT:

National Science Foundation Grant #2115169 (sub-award to NMSU) and New Mexico Office of Natural Resources Trustee (award to San Juan Soil and Water Conservation District)





# ENGAGING NAVAJO ELEMENTARY SCHOOLS IN A RANDOMIZED CONTROLLED TRIAL OF YÉEGO! HEALTHY EATING & GARDENING: PHASES OF DEVELOPMENT

Investigators: Kevin Lombard (klombard@nmsu.edu), Shirley A.A. BeresfordIndia Ornelas, Mark Bauer, Geraldine Garrity, Desiree Deschenie, Brandon Francis, Sonia Bishop, Feliz Nez, Filiberto Vecenti, Linda Garcia, Eileen Rillamas-Sun, Heather Wilcox, and Emily Brown

## PROJECT OVERVIEW

Type-2 diabetes is a serious issue in the Navajo Nation. Interest in healthy foods through gardening is high but few garden-based interventions are rigorously evaluated. ASC Farmington researchers and staff first conducted focus groups, which informed three phases of interventions informally referred to the Yéego! (Let's Go!) Healthy Eating & Gardening project: Yéego! 1 was a pre-pilot focusing on adults in two community gardens. Yéego! 2 shifted to elementary students and their parents and was piloted within a charter school. Yéego! 3 expanded Yéego! 2, randomized within six elementary schools in northern and central agencies of the Navajo Nation. The project has been supported by the Navajo Nation Human Research Review Board under protocols NNR 16.257 and NNR 19.333.

## MEETING THE NEEDS OF NEW MEXICO

The long-term goal is to enhance the consumption of fresh produce among the Navajo (Diné) and their neighbors, to reduce the rate of diabetes in the context of local food sovereignty.

## IMPACT

Project investigators have found a significant intervention effect on child self-efficacy for eating fruits and vegetables, and in growing fruits and vegetables through an integrated healthy eating and school gardening curriculum.

### FUNDING ACKNOWLEDGMENT:

Partnership for the Advancement of Cancer Research, supported in part by National Cancer Institute grants U54 CA132383 (NMSU) and U54 CA132381 (Fred Hutch)





# WEATHER DATA 2023

Investigator: Margaret M. West

## PROJECT OVERVIEW

NMSU's Agricultural Science Center at Farmington (ASCF) has recorded and monitored weather data since 1969. The ongoing daily and historical weather data is disseminated for use by interested stakeholders. The Weather Annual Data Report - 2023 Fifty-five Years (1969-2023) of Climatological Data: NMSU Agricultural Science Center at Farmington can be found by visiting ASCF Daily and Historical Weather web page <https://farmingtonsc.nmsu.edu/research/weather.html>.

## MEETING THE NEEDS OF NEW MEXICO

Weather data are used by the U.S. Department of Agriculture Natural Resources Conservation Service (USDA-NRCS) San Juan District, large and small acreage agricultural producers, and municipalities for water demand planning and monitoring flood events, by private end-users for irrigation scheduling and used in agricultural research. This varying and ongoing need for weather data demonstrates the importance of long-term weather monitoring for the region.

## IMPACT

In the New Mexico Four Corners region local industries and municipalities rely on surface water from the San Juan, Animas, and La Plata Rivers, which converge in Farmington, NM, and then flow into the Colorado River at Lake Powell in Utah. This water use is regulated for natural resources, agricultural, industrial, municipal, and residential use. Weather data collection and subsequent monitoring of the NMSU's ASC Farmington's National Weather Service 1 and the New Mexico Climate Center Station 2 is crucial to inform those interested in global and regional environments and local economic impacts within the region.

### FUNDING ACKNOWLEDGMENT:

National Oceanic and Atmospheric Administration (NOAA) National Weather Service (NWS) - Albuquerque, NM and New Mexico Climate Center for maintenance and equipment housed at the NMSU's Agricultural Science Center at Farmington.



New Mexico Climate Center (WS-2) NMSU Farmington

# BRINGING BROADBAND TO NEW MEXICO STATE UNIVERSITY AND SURROUNDING COUNTIES PILOT AT ASC FARMINGTON

Investigators: Carlos Herrera (herrerca@nmsu.edu), Kevin Lombard, Brian Hinds, and Marcus Krohn

## PROJECT OVERVIEW

The agricultural research and science centers located strategically around the state find themselves limited in broadband accessibility, with some areas not even supporting a strong cell signal. This limits the types of research that can be done in the area as well as the technology that can be used to support the local community. To this end, NMSU ACES IT, AES and NMSU Director of Instruction and Research Support teamed up with the National Telecommunications and Information Administration (Connecting Minority Communities Pilot Program Team, Office of Internet Connectivity and Growth). ACES IT staff traveled from the NMSU main campus in November 2023 to work with the ASC Farmington crew to assemble the trailers. Support was provided by the Navajo Agricultural Products Industry IT staff who provided additional expertise and a bucket truck to help modify the ASC Farmington telecommunications tower, located adjacent to the main office building. We thank the NTIA for their support of this pilot project.

## MEETING THE NEEDS OF NEW MEXICO

Farmington Agricultural Science Center (ASC) is a flagship location for bringing broadband to farming practices in support of the Navajo Nation. To support research in Precision Agriculture, NMSU ACES IT introduced a network of infrastructure across acres of farmland at the ASC Farmington research center. The aim is to provide internet access, powered by solar panels, to remote locations across the center that have poor to no cell phone access.

## IMPACT

Students and researchers will power and connect IoT devices, like sensors, microcontrollers, and other instruments, to stations scattered across the farmland and supported by this network infrastructure. Each station includes a telescopic mast for safely mounting IoT devices high above 25ft, ethernet and Wi-Fi connection to the internet, renewable power sources with support for Power-Over-Ethernet (POE+), programable 4K Infrared security cameras, and lockable, NEMA-rated enclosures to house IoT devices for researchers and students safely.

### FUNDING ACKNOWLEDGMENT:

Supported by National Telecommunications and Information Administration [NTIA] grant





# BY THE NUMBERS





# RESEARCH PUBLICATIONS

- Beresford, S. A. A., Ornelas, I. J., Bauer, M. C., Garrity, G. A., Bishop, S. K., Francis, B., Rillamas-Sun, E., Garcia, E. L. V., Vecenti, F. S. A., Deschenie, D., & Lombard, K. A. (2023). Healthy Eating and Gardening Intervention in Navajo Elementary Schools (Yeego!) Curriculum.
- Beresford, S. A. A., Rillamas-Sun, E., Rudd, K., Bishop, S. K., Deschenie, D., Ornelas, I. J., Bauer, M. C., & Lombard, K. A. (2023). Development of an Assessment Tool to Measure Healthy Eating in Navajo Children and Their Families. *Current Developments in Nutrition*, 7, 1-10.  
<https://doi.org/10.1016/j.cdnut.2023.100074>
- Beresford, S. A.A., Ornelas, I., Garrity, G. A., Bauer, M. C., Bishop, S. K., Vreeke, A., Garcia, L. V., Francis, B., Rillamas-Sun, E., Lombard, K. A. (in press). Impact of a school-based intervention and the COVID-19 pandemic on healthy eating in Navajo families: Results from the Yéego! Healthy Eating and Gardening Intervention Trial. *Preventative Medicine Reports*
- Estradé, M., Basurto, S. G. A., McCarter, A., Gittelsohn, J., Igusa, T., Zhu, S., Poirier, L., Gross, S., Pardilla, M., Rojo, M., Lombard, K., Haskie, H., Clark, V., Swartz, J., & Mui, Y. (2023). A Systems Approach to Identify Factors Influencing Participation in Two Tribally-Administered WIC Programs. *Nutrients*, 15(5), 1-11.  
<https://doi.org/10.3390/nu15051210>
- Lauriault, L., I. Ray, C. Pierce, K. Djaman, R. Flynn, M. Marsalis, C. Havlik, M. West. The 2023 New Mexico Alfalfa Variety Test Report. NMSU College of Agriculture, Consumer and Environmental Sciences, Agricultural Experiment Station. (2023)
- Lombard, K. A., & Wilsey, B. (2023). History of Horticulture in San Juan County, New Mexico and Legacy of Dr. Jack Jordan, New Mexico State University Agricultural Science Center at Farmington. American Society for Horticultural Sciences, Orlando, FL. (August 4, 2023). *HortScience*, 58(9), S294-295.
- Lombard, K. A., Giese, W., & Velasco-Cruz, C. (2023). Field Evaluation and Marketability of Table Grape Cultivars for Northwest New Mexico. American Society for Horticultural Sciences, Orlando, FL. (August 4, 2023). *HortScience*, 58(9), S245.
- Shrestha, B.; Darapuneni, M.; Stringam, B.L.; Lombard, K.; Djaman, K. Irrigation Water and Nitrogen Fertilizer Management in Potato (*Solanum tuberosum* L.): A Review. *Agronomy* 2023, 13, 2566.  
<https://doi.org/10.3390/agronomy13102566>
- West, M.M., D.W. DuBois and K.A. Lombard. Fifty-three Years (1969-2021) of Climatological Data: NMSU Agricultural Science Center at Farmington, NM. ADR 300-2023. (2023).

# GRANTS AND CONTRACTS

- Developing region-specific guidelines for selecting cover crop species in New Mexico. This research was supported by a grant from the USDA Natural Resources Conservation Service to the NMSU Department of Entomology, Plant Pathology, and Weed Science (NR238C30XXXXC003). Status: active (2023-2027; \$250,000 to NMSU).
- Using cover crops in transitioning from traditional agriculture to climate-adaptive organic farming in the Southwestern U.S.: This research was supported by a grant from the USDA/National Institute of Food and Agriculture (NIFA) Organic Transitions to NMSU Plant and Environmental Sciences and ASC Farmington (2022-51106-38061). Status: active (2022 – 2026; \$744,971 to NMSU).
- Cold tolerance of puncturevine weevils. This research was supported by grants from Western IPM Centers and USDA- Animal and Plant Health Inspection Service (APHIS) to NMSU Department of Entomology, Plant Pathology, and Weed Science (GR0007701). Status: active (2023-2024; \$15,000 to NMSU)
- Chip and table potato genotype evaluation and cropping systems: This research was supported by a grant from Potato USA to NMSU Department of Plant and Environmental Sciences/ASC Farmington (GR0007586). Status: active (2023-2024; \$ 23,500 to NMSU).
- Navajo Peach Project: This research was supported by a grant from the Utah Department of Agriculture and Food (UDAF) - Utah Specialty Crop Block Grant to Utah State University (grant number 203994). Status: active (\$21,943 to USU).
- Field Evaluation and Marketability of 15 Table Grape Varieties for NM: This research was supported by a grant from the New Mexico Department of Agriculture Specialty Crop Block Grant to the Departments of Plant and Environmental Sciences/Extension Plant Sciences (ASCs at Farmington, Alcalde, and Los Lunas) (USDA-AMS-TM-SCBGP-G-19-003). Status: completed (\$52,818 to NMSU).
- Northwest Agriculture Restoration Project: This research was supported by a grant from the New Mexico Attorney General's Office to the NMSU Department of Plant and Environmental Sciences and Cooperative Extension Service (ASC Farmington and San Juan County Cooperative Extension Service) (GR0007668). Status: active (2023-2025; \$415,308 to NMSU ASC Farmington).
- Transformation network Four Corners, Three Rivers working group of the SRS RN: transforming rural-urban systems: trajectories for sustainability in the intermountain West: This research was supported by a grant from the National Science Foundation's Sustainable Regional Systems Program through University of New Mexico to the NMSU Department of Plant and Environmental Sciences/ASC Farmington (NSF Grant# 2115169). Status: active (2021-2026; \$250,000 to NMSU).
- Engaging Navajo elementary schools in a randomized controlled trial of Yéego! Healthy Eating & Gardening: phases of development. This research was supported by a grant from the Partnership for the Advancement of Cancer Research to the NMSU Department of Plant and Environmental Sciences /ASC Farmington (National Cancer Institute grants U54 CA132383 [NMSU] and U54 CA132381 [Fred Hutch]. Status: completed.
- Bringing broadband to New Mexico State University and surrounding counties pilot at ASC Farmington: This work was supported by a grant from the National Telecommunications and Information Administration [NTIA] to NMSU (Connecting Minority Communities Program award). Status: active (\$120,000 direct costs for ASC Farmington).

# OUTREACH ACTIVITIES

- **January 6, 2023:** Invasive tree removal workshop: Diné College Shiprock land-grant office.
- **February 9, 2023:** Star School Training on Yéego Healthy Eating and Gardening Curriculum, Flagstaff, AZ.
- **March 2, 2023:** Transplanting workshop, Diné College Shiprock land-grant office.
- **March 8, 2023:** Pruning workshop, ASC Farmington Vineyard
- **March 21, 2023:** Organic transitions workshop, ASC Farmington
- **March 23, 2023:** Navajo Preparatory School (Farmington, NM) seep planting workshop at the ASC Farmington (about 40 science students).
- **March 30, 2023:** Massachusetts Institute of Technology (MIT) student tour, ASC Farmington (about 20 students).
- **May 3, 2023:** ASC Farmington Disease in Chili Pepper workshop
- **May 5, 2023:** New Mexico Agricultural Leadership Tour ASC Farmington
- **May 10, 2023:** KOB 4, Steve Stucker Farwell Tour stop (Community Awareness)
- **May 10, 2023:** 1st Annual ASC Farmington Plant Sale and Open House
- **May 16, 2023:** Fort Lewis College/Colorado School of Mines ASC Farmington farm tour and service project (about 15 undergrad and graduate students). Grad student Emiliano McLane provided a tour and service-learning project (Recruitment opportunity)
- **June 20, 2023:** Fozzy's Farm high school student visit (about 8-9 students). Grad students Emiliano McLane and Brandon Francis provided a tour and service-learning project. Recruitment opportunity.
- **June 22, 2023:** Career Day AgTivity Camp, CES San Juan Branch, Aztec, NM (high school student career fair). Dr. Koffi Djaman interacted with 4H kids to provide an overview of plant science career paths and recruitment.
- **Aug 7, 2023:** Dream Diné Charter School (Community Outreach). Presentation of Final Results to teachers and principal and hand-over of curriculum and overview of ASC Farmington activities.
- **August 10, 2023:** Shiprock Chapter House August Meeting Presentation (Community Outreach)
- **August 17:** ASC Farmington Annual Field Day; about 300 guests
- **October 11, 2023:** 1st Annual Farm Day and Pumpkin Giveaway, K-5 elementary students (about 250 students and their teachers participated). Gasper Martinez, Research Associate, took leadership in growing pumpkins and lining out the agenda to include speaker tables and speakers on topics that ranged from pumpkin lifecycle and seed saving to a plot combine demonstration. A corn maze was created with support from Basin Coop (Durango, CO). The goal of the event was to raise awareness among elementary kids about farming activities and to give something back to the community, in this case, a pumpkin to each visiting student.
- **October 16-17, 2023:** Navajo Nation Human Research Review Board Conferences. Outreach to the Navajo Nation



# OUTREACH ACTIVITIES





# PEOPLE





# COOPERATORS AND COLLABORATORS

## NMSU

- Agricultural Experiment Station (AES) and Science Centers (Statewide)
- College of Agricultural, Consumer, and Environmental Sciences (ACES), Las Cruces, NM
- College of Agricultural Consumer and Environmental Sciences IT Department.
- College of Engineering, Las Cruces, NM
- Department of Plant and Environmental Sciences
- Department of Agriculture and Extension Education
- McKinnley County Cooperative Extension Service, Gallup, NM
- NMSU Tribal Cooperative Extension Service
- NMSU ICT-Networking
- San Juan County Cooperative Extension Service, Aztec, NM

## OTHER UNIVERSITY

- Colorado State University, San Luis Valley Research Center, Center, CO
- Colorado State University, Southwestern Colorado Research Center, Yellow Jacket, CO
- Diné College, Shiprock, NM/Tsaile, AZ
- Fort Lewis College, Durango, CO
- Land Institute, Salina, KS
- New Mexico Tech
- Northern Arizona University, Center for Ecosystem Science and Society, Flagstaff, AZ
- University of Arizona, Native FEWS Alliance, Tucson, AZ
- University of Minnesota Department of Agronomy and Plant Genetics, St. Paul, MN
- University of New Mexico, Intermountain Transformation Network, Albuquerque, NM
- University of Washington School of Public Health/Fred Hutchinson Cancer Research Center, Seattle, WA
- Utah State University, San Juan County Cooperative Extension Service, Monticello, UT
- Washington State University



# COOPERATORS AND COLLABORATORS

## STATE, FEDERAL, AND TRIBAL

- Navajo Nation Human Research Review Board, Window Rock, AZ
- National Oceanic Atmospheric Administration (NOAA) – National Weather Service at Albuquerque, NM
- New Mexico Department of Agriculture, Las Cruces, NM
- New Mexico Climate Center
- San Juan Soil and Water Conservation District, Aztec, NM
- USDA Agricultural Research Service, U.S. Potato Genebank, Sturgeon Bay, WI
- USDA NRCS, New Mexico, San Juan County Soil and Water Conservation District 1, Aztec, NM

## INDUSTRY

- Basin Cooperative, Durango, CO
- Fred Hutchinson Cancer Research Center
- Navajo Agricultural Products Industry (NAPI), Farmington, NM
- Navajo Mesa Farms, Farmington, NM
- Northern Navajo Agency
- Potatoes USA, Denver, CO
- Quality Irrigation Solutions, Cortez, CO
- Valley Irrigation (Valmont Industries), Valley, NE

## COMMUNITY

- Dream Diné Charter School, Shiprock, NM
- Navajo Ethno-Agriculture, Nenahnezad, NM
- San Juan River Farm Board, San Juan County, NM
- Shiprock Area Food Access Coalition, Shiprock, NM

# ADVISORY COMMITTEE

- Bonnie Hopkins (NMSU San Juan County Cooperative Extension)
- Carol Cloer (Hammond Ditch; Cloer Hay)
- Dave Arnold (Turley Manzanarez ditch; Wines of the San Juan, Blanco NM)
- Dave Zeller (Navajo Agricultural Products Industry; NIIP canal)
- Dineh John (Navajo Agricultural Products Industry; NIIP canal)
- Gary Hathorn (Farm Bureau)
- Gloria Lane (Navajo Ethno Agriculture, Fruitland Canal)
- Renae Pablo (Navajo Agricultural Products Industry; NIIP canal)
- Tracey Raymond (President, San Juan River Irrigation Board, Nenahnezad Chapter)
- Zach Ben, Bididi Baby Foods

# UNDERGRADUATE & GRADUATE STUDENTS / INTERNS

- Aminou Saibou, NMSU Graduate Research Assistant
- Bhimsen Shrestha, NMSU Graduate Research Assistant
- Brandon Francis, NMSU Graduate Research Assistant
- Emiliano McLane, NMSU Graduate Research Assistant
- Emily Brown, Masters of Public Health
- Gabbi Henderson, San Juan College
- Heather Wilcox, Masters of Public Health
- Korbin Nakai, Kirtland High School/Navajo Technical University
- Melvin Cooley, Kirtland High School/San Juan College

# ASC PERSONNEL

## **DALLEN BEGAY**

Farm Manager

## **CHAD BEGAY**

Ag Science Center Laborer

## **COREY BENALLY**

Administrative Associate

## **KOFFI DJAMAN**

Associate Professor  
Agronomy

## **JONAH JOE**

Ag Science Center Laborer

## **KEVIN LOMBARD**

Research Director  
Professor of Horticulture

## **GASPER MARTINEZ**

Associate Research Scientist

## **FRANKLIN JASON THOMAS**

Farm and Ranch Supervisor

## **MARGARET WEST**

Associate Research Scientist



# ASC PERSONNEL



ASC Farmington Staff (left to right): Corey Benally, Chad Begay, Dallen Begay, Jonah Joe, Koffi Djaman, Kevin Lombard, Gasper Martinez, Jason Thomas, and Margaret West



ASC Farmington graduate students (left to right): Brandon Francis, Emiliano McLane, Aminou Saibou